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THE FUTURE OF FOREST PARASITES IN THE
UNITED STATES

THE FUTURE OF FOREST PARASITES IN THE UNITED STATES¹

By J. S. BOYCE

Director, Northeastern Forest Experiment Station

INCE the experience of the writer has been largely with fungus parasites and less with insect parasites of forest trees, this paper will concern itself mostly with parasitic fungi, but the general principles discussed are applicable to both insects and fungi.

Forest parasites can be divided into two broad classes, introduced and native, and between the two there are very marked differences both as to behavior and methods of control, differences which it seems the forestry profession does not fully appreciate, to judge from the rather apathetic attitude or even individual opposition in the past to control measures directed against an introduced parasite. An introduced parasite frequently threatens the commercial extinction of a tree species; a native parasite never does so. Chestnut blight (*Endothia parasitica*) brought in from Asia is rapidly reducing chestnut (*Castanea dentata*) from its position of an unusually valuable forest tree to that of a shrub. This has already resulted in a very heavy reduction of forest land values within the range of chestnut. Furthermore, native parasites can be largely controlled by proper silvicultural practice, but it is difficult to visualize any silviculture that could control chestnut blight

or even white pine blister rust (*Cronartium ribicola*), an importation from Europe, although some aid to control can be attained with this last named parasite by maintaining a fully stocked stand of pine, so that currant and gooseberry bushes cannot find openings in the stand in which to establish themselves. For most introduced parasites direct control is necessary, and direct control is expensive.

After an introduced parasite has been discovered there are two courses open—do nothing and let a tree species be wiped out, either because it is not considered valuable enough to save or because it will be replaced by other valuable species; or apply direct control measures. In some cases both courses may be followed, as with chestnut blight, when the policy of apathy was replaced by action after the parasite had spread beyond hope of control. Justification for this policy of following the line of least resistance may be had if in the future the chemist reduces wood to cellulose and lignin so that one species is as good as another for the end product. Red spruce (*Picea rubra*) would then have no advantage over red maple (*Acer rubrum*) for pulp, or western white pine over white fir (*Abies concolor*) for boards. But it does not seem advisable to let our action against introduced parasites be influenced until this possibility becomes an actuality. Furthermore, the decision as to whether

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or not a species should be protected by direct control should be largely left to foresters. The rôle of the pathologist or entomologist is to thoroughly investigate the parasite, in advance of the introduction if possible, and advise as to what it may be expected to do and the methods to be used in its control.

Another argument in favor of not attempting to control directly an introduced parasite is that an exotic tree species can be used to replace the doomed native tree. The cost of this may well exceed the cost of direct control of the introduced parasite. Fortunately it is now becoming recognized that the importation of foreign nursery stock is a most dangerous practice, which at any time may result in another disastrous epidemic similar to chestnut blight or white pine blister rust, and that foreign species should be introduced only as seed and the stock grown here. But any exotic tree is an uncertain quantity and if introduced should be grown experimentally only, until such time as its desirability and success is well established. It is not until the end of the rotation that final judgment can be rendered as to the success or failure of an introduction. First, there is the problem of securing seed of the best quality from the optimum, native range of the species; second, the difficulty of proper site selection; and finally, the possibility that the species sometime in its life may be attacked by a native parasite hitherto not serious. Any one of these factors can spell failure. The Macedonian pine (*Pinus peuce*), because of its resistance to blister rust, is a possible substitute for western white pine (*P. monticola*), but the reaction of Macedonian pine to two canker diseases (*Scleroderris* sp. and *Dasyscypha fusco-*

sanguinea) common to western white pine within its natural range is highly problematical. Furthermore there is no information as to the rate of growth or form of this tree when established in North America.

Nevertheless circumstances which cannot be foreseen or controlled may some day necessitate the extensive establishment of a foreign species in this country. To meet such a situation experimental plantings of exotic species should be established in the various forest regions to determine the reaction of promising foreign species to a new environment. These plantings cost relatively little to start and maintain, but require a long time to develop and furnish complete information. The knowledge obtained by the British through arboreta and experimental plantations has been the basis for their extensive campaign of reforestation, prosecuted so vigorously since the World War.

Finally there is the possibility of developing a strain of the native tree resistant to the introduced parasite, as is now being attempted with chestnut against chestnut blight, but this too is an uncertain and time-consuming measure.

With constantly increasing intercommunication with foreign lands, there will inevitably be an increase in introduced parasites, checked in a considerable measure by quarantines. In Europe the Dutch elm disease (*Graphium ulmi*), of unknown origin, but probably brought in during the World War, is now destroying the elms and is a constant menace to the elms of this country. Douglas fir canker (*Phomopsis pseudotsugæ*) in Europe is another constant threat. There is not only the danger of introducing new diseases but that of introducing virulent

strains of parasites already present. For example in the Pacific Northwest, conifer root rot (*Fomes annosus*) is found on old stumps or dead trees of Douglas fir (*Pseudotsuga taxifolia*) and occasionally causes root and butt rot in a mature tree, but in Europe this organism commonly attacks and kills young Douglas firs.

Furthermore, the United States is such a large country, with the forests of the East and the West so well separated, that there is danger of introducing forest parasites from one of these regions to the other. It is quite possible that one of the dwarf mistletoes (*Razoumofskya* spp.) so severe on western pines might find one of the eastern or southern pines a congenial host. It is the writer's opinion that the gall forming rust (*Peridermium* sp.) on Scotch pine (*Pinus sylvestris*) discovered in New York within recent years and known as the Woodgate rust has been introduced from the West. In April, 1928, the writer found Douglas fir needle cast (*Rhabdocline pseudotsugæ*) on planted Douglas fir in eastern Massachusetts. This fungus was either introduced directly from the West or came circuitously by way of Europe. The introduction of the western pine gall rust (*Cronartium harknessii*) from the Black Hills of South Dakota to the pine plantations in the sand hills of northwestern Nebraska on forest grown stock was a serious error that should have been avoided. The movement of nursery stock from one part of the United States to another is a dangerous practice.

The system of government in this country in which the police power is vested in the states makes it more difficult to handle campaigns against introduced parasites, since a state is reluctant to spend money or antagonize its own citi-

zens for the protection of a remote state. The European larch canker (*Dasyscypha willkommii*) which has been discovered in eastern Massachusetts on European larch (*Larix europæa*) and Douglas fir is of no importance to Massachusetts, but is of grave consequence to the Pacific Northwest states.

Although the biggest single step in protecting forests against foreign parasites has been the enactment of Quarantine 37, the fact must be faced that in the final analysis quarantines must be considered as measures of delay rather than measures of exclusion, even though some parasites may be prevented from reaching this country for all time. The agency responsible for enforcing this quarantine should have the strongest support of all those genuinely interested in the ultimate future of agriculture in this country. How anyone of unbiased mind can consider the losses caused by chestnut blight, white pine blister rust, gypsy moth, citrus canker, European corn borer, and Japanese beetle together with other introductions and still advocate the unrestricted importation of plants from foreign countries is beyond comprehension. Unfortunately there is reason to believe that plant bootlegging is not an unknown practice.

The respite granted by quarantines should be used to obtain as intimate a knowledge as possible not only of dangerous foreign parasites but of parasites native to this country. The fights in the past against introduced parasites have been badly hampered, not only by lack of knowledge of the virulent introduction, but of native species closely related to it. Chestnut blight was at first thought by some to be a native fungus suddenly become epidemic through meteorological

conditions unfavorable to the host, and later this idea was strengthened by the presence of a closely related native fungus (*Endothia virginiana*) on oaks. Piñon blister rust (*Cronartium occidentale*) caused some confusion in the West with white pine blister rust, from which it cannot readily be absolutely distinguished. As a defense against further introductions, it will be necessary to station men abroad to study foreign parasites in their native haunts, particularly in those countries most closely united commercially with our own, as is now being done with the Douglas fir canker.

Except from the heartrots, which will be largely controlled by a reduction in the felling age, as times goes on there will be an increase in losses from native parasites, now little considered or scarcely recognized. This will result as forests are brought under intensive management, so that trees attain the status of cultivated plants. Yet many of these losses can be avoided. Our silviculture should emulate nature, improve on her methods but not radically change them. Where nature has provided a mixed forest, the same relative composition should be maintained, for mixed stands are far less susceptible to fungus and insect attacks than pure stands. The lessened damage by the white pine weevil (*Pissodes strobi*) to northern white pine (*Pinus strobus*) in mixed stands as contrasted to pure stands is a case in point. Clear cutting should be avoided as far as possible except where it has been nature's way. In general the sudden and complete exposure of the soil resulting from this method cannot but be less favorable to the new stand. The selection or shelterwood method should be practiced and

when cuttings are made diseased and undesirable trees should be eliminated.

Stands should be reproduced naturally and planting avoided, unless no other method will serve. Experience has shown that planted stands are more susceptible to disease, particularly root rots, than those naturally regenerated. But if planting must be resorted to there are certain principles to be followed. The source of seed is highly important. The seed should be obtained from stands in a climate similar to that where it is to be used, from stands on the better sites, and from thrifty mother trees. Furthermore, plantations should be established on sites suitable to the species. This precaution seems scarcely worth mentioning, but it is often neglected. Where forest conditions have been destroyed over extensive areas by devastating fires for example, it is often difficult to completely re-establish the species which previously occupied the ground. On the less favorable situations the trees grow slowly, and readily succumb to parasites. It is not until such time as the surrounding stands are large enough to afford adequate protection that trees can be re-established on such situations. An example of this is to be seen in the Douglas fir plantations on the Mt. Hebo area in Oregon.

Planting, of course, has a definite place, but because of its strong appeal to the imagination it may be overdone. There is a decided temptation for an industry which finds one type of wood best suited for its use growing in a mixed stand, to attempt to change the mixture to a pure stand of the desirable species by planting. To the pulp industry, pure stands of spruce would be much more desirable than the mixed stands, from which

spruce now comes, but if pure stands are established heavy expenditures will ultimately have to be made for soil fertility and protection against parasites in order to maintain production, just as is now done in agriculture.

To sum up then, increased losses are to be expected from introduced parasites in spite of our quarantine laws and we must prepare to meet these unwelcome guests by carefully studying them in their

own homes and obtaining a thorough knowledge of similar native parasites, so that immediate action can be taken when the necessity arises. Losses from native parasites, now considered of little importance, will also increase, but ultimately these losses will be controlled by proper silviculture. Finally, no management plans can be considered complete which do not take fully into account the possible losses from forest parasites.